International Journal of Current Pharmaceutical Research

ISSN- 0975-7066 Vol 17, Issue 4, 2025

Original Article

COMPARISON OF PATIENT-REPORTED OUTCOMES BASED ON IMPLANT BRAND IN TOTAL KNEE ARTHROPLASTY

AMANDEEP SINGH BAKSHI, MUKUL SHARMA, JASPREET SINGH, MUDIT KUMAR SHARMA, HARRY MEHTA*, ABHISHEK

Department of Orthopaedics, GMC Patiala, Punjab, India
***Corresponding author: Harry Mehta; *Email: hk02266@gmail.com**

Received: 18 Apr 2025, Revised and Accepted: 12 Jun 2025

ABSTRACT

Objective: This study aims to evaluate patient-reported outcomes and satisfaction following primary TKA in patients with osteoarthritis, specifically using four distinct brands of posterior-stabilized implants.

Methods: Conducted as a prospective study, this research assessed patient-reported functional outcomes and satisfaction after TKA with four brands of posterior-stabilized implants. The Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Short Form Health Survey (SF-12) were utilized to evaluate functional outcomes pre-operatively and post-operatively at 3 mo, 6 mo and 1 y intervals. Data was summarized in Microsoft Excel and analyzed using SPSS software.

Results: The cohort consisted predominantly of patients over 60 y of age. A higher female prevalence was observed across all groups ($p = 0.9389$). Significant intra-group improvements in KOOS and SF-12 scores were recorded ($p<0.00001$), but no significant inter-group differences were found ($p>0.05$).

Conclusion: This study illustrates that TKA significantly improves patient-reported outcomes, as indicated by KOOS and SF-12 scores, across different implant brands. Despite notable improvements within each group, no substantial inter-group differences suggest that surgical technique and patient characteristics may play a more critical role in functional recovery and satisfaction than the specific prosthetic design. These results highlight the importance of a comprehensive approach to TKA patient management and recommend future research into the long-term effects of implant technology on recovery outcomes.

Keywords: Total knee arthroplasty, Knee injury and osteoarthritis outcome score (KOOS), Short form health survey (SF-12), Knee osteoarthritis

DOI: https://dx.doi.org/10.22159/ijcpr.2025v17i4.7017 Journal homepage: https://innovareacademics.in/journals/index.php/ijcpr

INTRODUCTION

Total knee arthroplasty (TKA) has become increasingly prevalent, reflecting the growing demand for effective interventions to address debilitating joint conditions [1]. As a result, arthroplasty procedure now represent one of the largest expenditures within the Medicare budget, underscoring their significance in the healthcare landscape [2]. Over the past three decades, the costs associated with TKA have escalated dramatically, with implant prices emerging as a substantial component of the overall expenditure. This trend has prompted a renewed focus on value-based healthcare, where the quality of patient outcomes is evaluated in relation to the costs incurred during treatment [3].

In this context, it is essential to scrutinize all elements contributing to the cost-effectiveness of TKA, particularly the choice of implant. Despite the wide variation in implant prices, the existing literature lacks comprehensive data on which specific implants yield the best clinical outcomes while minimizing complications [4]. Notably, while TKA is generally regarded as a highly cost-effective procedure, approximately 20% of patients report dissatisfaction with their surgical outcomes. This discrepancy highlights the need for further investigation into the factors that influence patient satisfaction and functional recovery [5].

Previous studies have explored the functional outcomes and survivorship associated with various implant designs, revealing significant differences based on the specific characteristics of the devices used. For instance, Hamilton *et al.* conducted a randomized controlled trial comparing two designs from a single manufacturer, demonstrating that the newer design significantly improved patient-reported outcomes and performance on timed functional tasks [6]. Similarly, Victor *et al.* investigated the survivorship of the Smith and Nephew Genesis I and Genesis II implants, finding enhanced survivorship with the latter [7]. Conversely, Nunley *et al.* compared newer cruciate-retaining designs to an older model, concluding that the older design outperformed its successor in terms of patient satisfaction and functional outcomes among younger patients [8].

Despite these valuable contributions to the understanding of implant performance, there remains a notable gap in the literature regarding the comparative evaluation of patient-reported functional outcomes and satisfaction across different brands currently utilized in primary TKA. Given that implant costs constitute a significant portion of TKA expenditures, understanding the performance and patient-reported outcomes associated with various brands is crucial for patients, surgeons, and policymakers alike [9].

Outcomes following TKA are influenced by a multitude of factors, including surgeon skill, patient characteristics, and the specific implant utilized. However, the extent to which different implants impact patient-reported outcomes remain largely unexplored [10, 11]. Therefore, the primary objective of this study is to evaluate the differences in patient-reported functional outcomes and satisfaction following primary TKA using four distinct brands of posterior-stabilized implants. We hypothesize that there will be no significant differences in functional outcomes attributable to the specific implant used in primary TKA. This research aims to fill the existing knowledge gap and provide valuable insights that could inform clinical decision-making and enhance patient care in the field of orthopedic surgery.

MATERIALS AND METHODS

Study design

This research was conducted as a prospective study aimed at evaluating patient-reported functional outcomes and satisfaction following total knee arthroplasty (TKA) using four different brands of posterior-stabilized implants.

Subject recruitment

Eligible patients who provided written consent were included in the study. Interested patients were given a thorough explanation of the study, including the consent process, in a confidential manner within a private room. Questions regarding the study were addressed to ensure understanding before participation.

Inclusion criteria

Patients were eligible for inclusion if they met the following criteria:

1. Underwent total knee arthroplasty using posterior-stabilized implants due to primary osteoarthritis.

Exclusion criteria

Patients were excluded from the study if they met any of the following criteria:

1. Had osteoarthritis due to secondary causes.

2. Underwent revision surgeries or surgeries performed using cruciate-retaining implants.

Early withdrawal of subjects

Participants were informed at the time of consent that their participation in the research was entirely voluntary and that they could withdraw from the study without penalty at any time.

Withdrawal procedures

1. **Withdrawal by subject decision:** A participant may withdraw from the study at any time by notifying the principal investigator or another member of the research team. The investigator will clarify whether the participant wishes to withdraw from all components of the study or just specific aspects. If the latter is chosen, follow-up data collection for previously consented activities may continue.

2. **Withdrawal by investigator decision:** An investigator may terminate a participant's involvement in the study if it is deemed necessary to protect the participant from excessive risk or when there is a demonstrated lack of benefits. This may also occur to maintain the integrity of the data, such as if a participant fails to adhere to study procedures or provides false information. Participants lost to follow-up will also be documented.

Screening of participants

All patients admitted under the Department of Orthopaedics at Rajindra Hospital and Government Medical College, Patiala, from August 1, 2024, to December 31, 2024, were screened according to the established inclusion and exclusion criteria.

Baseline assessment

Following confirmation of eligibility and informed consent, baseline assessments were conducted. This assessment included the collection of demographic information such as age, sex, and the affected side.

Schedule of measurements

Outcomes were measured at one-year post-surgery using the following validated instruments:

- **Knee injury and osteoarthritis outcome score (KOOS):** To assess patient-reported outcomes related to knee function and quality of life.
- **Short form health survey (SF-12):** To evaluate overall health status and quality of life.

This structured approach ensures comprehensive evaluation and comparison of patient-reported outcomes across different brands of posterior-stabilized implants used in primary TKA.

For the evaluation, the results of various parameters from the individual patients were summarized in Microsoft excel sheet and were analyzed by SPSS software.

RESULTS

The demographic analysis of patients indicated a predominance of individuals aged over 60 y across all groups. The mean ages were as follows: 67.57±9.10 y for the Smith Nephew implant group, 67.97±8.98 y for the Meril implant group, 67.80±9.22 y for the TTK implant group, and 68.70±9.46 y for the Johnson and Johnson implant group, with no statistically significant difference (p = 0.9681). Additionally, a female preponderance was observed in all groups, which was also statistically nonsignificant (p = 0.9389).

The duration of hospital stay varied significantly, with the Smith Nephew group averaging 5.67±0.84 d, the Meril group 7.20±3.23 d, the TTK group 7.03±2.98 d, and the Johnson and Johnson group 5.57±0.93 d (p = 0.0061).

Table 1: Comparison of various parameters between different brands

Parameters	Smith nephew	Meril	TTK	Johnson and Johnson	p-value
mean age (years)	67.57±9.10	67.97±8.98	67.80±9.22	68.70±9.46	0.9681 (NS)
Gender	M (30%)	M (33.33%)	M (30%)	M (36.67%)	0.9389 (NS)
	F (70%)	F (66.67%)	F (70%)	F (63.33%)	
Hospital stays (days)	5.67±0.84 (4-7)	7.2±3.23 (4-15)	7.03±2.98 (4-14)	5.57±0.93 (4-7)	0.0061 (S)

Functional outcomes were assessed using the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Short Form Health Survey (SF-12) at pre-operative, 3 mo, 6 mo, and 1 y intervals. Pre-operative KOOS scores were 24.13±2.34 for the Smith Nephew group, 24.20±1.84 for the Meril group, 24.63±2.38 for the TTK group, and 24.10±1.86 for the Johnson and Johnson group. Significant intra-group changes in KOOS scores were observed at subsequent time points: Smith Nephew (52.83±1.64 at 3 mo, 62.50±1.43 at 6 mo, 67.47±1.55 at 1 y), Meril (53.23±1.28, 63.10±1.54, 67.37±1.37), TTK (52.97±1.52, 63.57±2.63, 67.83±1.51), and Johnson and Johnson (52.70±1.34, 63.10±1.45, 67.80±2.58). However, inter-group comparisons of KOOS scores across time points yielded no statistically significant differences (p>0.05).

Pre-operative SF-12 scores were recorded as follows: 28.10±3.64 for the Smith Nephew group, 26.33±3.76 for the Meril group, 27.97±3.93 for the TTK group, and 27.97±2.92 for the Johnson and Johnson group. Serial changes in SF-12 scores were significant within groups at 3 mo (Smith Nephew: 53.10±1.64; Meril: 53.23±1.33; TTK: 52.70±1.32; Johnson and Johnson: 52.90±1.18), 6 mo, and 1 y (p<0.00001). However, inter-group comparisons for SF-12 scores also demonstrated no statistically significant differences (p>0.05).

Overall, these results indicate significant improvements in both KOOS and SF-12 scores over time within each implant group, while inter-group differences were not statistically significant, suggesting comparable outcomes across the various implant types.

Table 2: Comparison of KOOS between different brands at different timepoints

Implant	Pre-operative	3 mo	6 mo	1 y	Intra-group p-value*
Smith nephew	24.13± 2.34	52.83±1.64	62.50±1.43	67.47±1.55	<0.00001 (HS)
Meril	24.2±1.84	53.23±1.28	63.10±1.54	67.37±1.37	<0.00001 (HS)
TTK	24.63±2.38	52.97±1.52	63.57±2.63	67.83±1.51	<0.00001 (HS)
Johnson and Johnson	24.1±1.86	52.7±1.34	63.10±1.45	67.80±2.58	<0.00001 (HS)
Inter-group p-value*	0.7473 (NS)	0.5319 (NS)	0.1700 (NS)	0.7552 (NS)	-

*ANOVA test applied

Table 3: Comparison of SF-12 between different brands at different timepoints

Implant	Pre-operative	3 mo	6 mo	1 y	Intra-group p-value*
Smith nephew	28.1±3.64	53.10±1.64	57.33±1.69	63.80±2.29	<0.00001 (HS)
Meril	26.33±3.76	53.23±1.33	58.50±1.68	62.67±1.37	<0.00001 (HS)
TTK	27.97±3.93	52.70±1.32	57.93±1.46	63.33±2.38	<0.00001 (HS)
Johnson and Johnson	27.97±2.92	52.9±1.18	57.60±1.40	62.53±1.57	<0.00001 (HS)
Inter-group p-value*	0.1814 (NS)	0.4135 (NS)	0.092(NS)	0.0658(NS)	-

*ANOVA test applied

DISCUSSION

TKA has evolved significantly since its introduction, with advancements in implant design aimed at enhancing both the longevity and functionality of prosthetic devices. This study contributes to the growing body of literature on patient-reported outcome measures (PROMs) by utilizing KOOS and SF-12 to evaluate functional outcomes in patients undergoing TKA.

Our findings indicate a predominance of female patients over 60 y of age, consistent with previous research that identifies older age as a significant risk factor for degenerative joint diseases necessitating TKA [12]. The average age of our cohort aligns with the findings of Bang *et al.* (2010), which reported an average age of 67 y for TKA patients [13]. The gender disparity observed, with women being three times more likely to undergo TKA, can be attributed to the higher prevalence of osteoarthritis, rheumatoid arthritis, and posttraumatic arthritis among females, as supported by existing literature [14, 15].

The results of our study demonstrated significant intra-group improvements in both KOOS and SF-12 scores over time, indicating that all implant types effectively enhance patient-reported outcomes postoperatively. Specifically, KOOS scores showed substantial increases at 3 mo, 6 mo, and 1 y post-surgery, with statistically significant changes ($p<0.00001$). However, inter-group comparisons revealed no significant differences among the various implant brands, suggesting that while all implants provide similar functional benefits, the choice of implant may not significantly influence patient satisfaction or outcomes.

Similarly, SF-12 scores exhibited significant improvements within each group across the time points measured, also with no significant inter-group differences. These findings are consistent with previous studies, such as that of Kahlenberg *et al.* (2019), which reported no clinically significant differences in KOOS scores among various implant types at two-year follow-up, further supporting the notion that patient satisfaction remains high across different prosthetic designs [16].

The comparative analysis of KOOS-JR and Knee Society scores in the study by Toossi *et al.* (2023) reinforces our findings, indicating that both generations of knee systems yield substantial improvements in patient-reported outcomes postoperatively, albeit with some differences in early functional scores. This suggests that while advancements in implant technology may enhance specific aspects of recovery, the overall effectiveness of TKA remains largely consistent across different devices [17].

Moreover, the study by Pennington *et al.* (2016) highlights the importance of considering not only functional outcomes but also cost-effectiveness in the selection of knee implants. The Nexgen implant, for instance, was noted for its superior post-operative quality of life and cost-effectiveness, underscoring the multifaceted approach required in evaluating TKA outcomes [18].

While significant intra-group improvements were observed, the lack of inter-group differences suggests that the choice of implant may be less critical than previously thought. Future research should continue to explore the long-term implications of implant design on patient satisfaction and functional recovery, as well as the cost-effectiveness of different prosthetic options in the context of TKA.

CONCLUSION

This study demonstrates that TKA significantly enhances patient-reported outcomes, as measured by KOOS and SF-12, across all implant brands analyzed. While notable intra-group improvements were observed, no substantial differences emerged between the various implants, indicating that factors such as surgical technique and patient demographics may play a more critical role in optimizing functional recovery and satisfaction than the specific prosthetic design. These findings emphasize the need for a holistic approach to TKA patient care and suggest directions for future research into the long-term effects of implant technology on recovery outcomes.

Ethical approval and Consent

Approval was taken from the institutional ethics committee and written informed consent was taken from each patient to publish his details while maintaining confidentiality.

FUNDING

Nil

AUTHORS CONTRIBUTIONS

All authors have contributed equally

CONFLICT OF INTERESTS

Declared none

REFERENCES

1. Pettit RJ, Gregory B, Stahl S, Buller LT, Deans C. Total joint arthroplasty and sleep: the state of the evidence. Arthroplast Today. 2024 Apr 24;27:101383. doi: 10.1016/j.artd.2024.101383, PMID 39071825.
2. Ball AM, Yu J. Cost containment of total knee arthroplasty in the US: DEA analysis on regional cost and clinical comparison between 2010 and 2013. Health. 2020 Jun 8;12(6):532-47. doi: 10.4236/health.2020.126042.
3. Fang CJ, Mazzocco JC, Sun DC, Shaker JM, Talmo CT, Mattingly DA. Total knee arthroplasty hospital costs by time-driven activity-based costing: robotic vs conventional. Arthroplast Today. 2022 Feb 13;13:43-7. doi: 10.1016/j.artd.2021.11.008, PMID 34917720.
4. Daigle ME, Weinstein AM, Katz JN, Losina E. The cost effectiveness of total joint arthroplasty: a systematic review of published literature. Best Pract Res Clin Rheumatol. 2012 Oct;26(5):649-58. doi: 10.1016/j.berh.2012.07.013, PMID 23218429.
5. Liu J, Yang Y, Wan S, Yao Z, Zhang Y, Zhang Y. A new prediction model for patient satisfaction after total knee arthroplasty and the roles of different scoring systems: a retrospective cohort study. J Orthop Surg Res. 2021 May 20;16(1):329. doi: 10.1186/s13018-021-02469-4, PMID 34016153.
6. Hamilton DF, Burnett R, Patton JT, Howie CR, Moran M, Simpson AH. Implant design influences patient outcome after total knee arthroplasty: a prospective double-blind randomised controlled trial. Bone Joint J. 2015;97-B(1):64-70. doi: 10.1302/0301-620X.97B1.34254, PMID 25568415.
7. Victor J, Ghijselings S, Tajdar F, Van Damme G, Deprez P, Arnout N. Total knee arthroplasty at 15-17 Y: does implant design affect outcome? Int Orthop. 2014;38(2):235-41. doi: 10.1007/s00264-013-2231-8, PMID 24346512.
8. Nunley RM, Nam D, Berend KR, Lombardi AV, Dennis DA, Della Valle CJ. New total knee arthroplasty designs: do young patients notice? Clin Orthop Relat Res. 2015 Jan 1;473(1):101-8. doi: 10.1007/s11999-014-3713-8, PMID 24903823.
9. Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? Clin Orthop Relat Res. 2010 Jan;468(1):57-63. doi: 10.1007/s11999-009-1119-9, PMID 19844772, PMCID PMC2795819.

10. Van Meirhaeghe JP, Harris IA, Cuthbert A, Lorimer M, McAuliffe M, Adie S. The influence of implant factors on patient outcomes in primary total knee arthroplasty. J Orthop. 2024 Jul 17;58:154-60. doi: 10.1016/j.jor.2024.07.011, PMID 39157416.
11. Escobar A, Quintana JM, Bilbao A, Azkarate J, Guenaga JI, Arenaza JC. Effect of patient characteristics on reported outcomes after total knee replacement. Rheumatology (Oxford). 2007 Jan 1;46(1):112-9. doi: 10.1093/rheumatology/kel184, PMID 16735451.
12. Petterson SC, Raisis L, Bodenstab A, Snyder Mackler L. Disease-specific gender differences among total knee arthroplasty candidates. J Bone Joint Surg Am. 2007;89(11):2327-33. doi: 10.2106/JBJS.F.01144, PMID 17974873.
13. Bang H, Chiu YL, Memtsoudis SG, Mandl LA, Della Valle AG, Mushlin AI. Total hip and total knee arthroplasties: trends and disparities revisited. Am J Orthop (Belle Mead NJ). 2010 Sep 1;39(9):E95-102. PMID 21290031.
14. Chancay MG, Guendsechadze SN, Blanco I. Types of pain and their psychosocial impact in women with rheumatoid arthritis. Womens Midlife Health. 2019;5:3. doi: 10.1186/s40695-019-0047-4, PMID 31417683.
15. Thomas AC, Hubbard Turner T, Wikstrom EA, Palmieri Smith RM. Epidemiology of posttraumatic osteoarthritis. J Athl Train. 2017;52(6):491-6. doi: 10.4085/1062-6050-51.5.08, PMID 27145096.
16. Kahlenberg CA, Lyman S, Joseph AD, Chiu YF, Padgett DE. Comparison of patient reported outcomes based on implant brand in total knee arthroplasty: a prospective cohort study. Bone Joint J. 2019;101-B(7_Supple_C):48-54. doi: 10.1302/0301-620X.101B7.BJJ-2018-1382.R1, PMID 31256639.
17. Toossi N, Bucklen B, Meding LK, Meding JB. Does design change in total knee arthroplasty implants affect patient-reported outcomes? BMC Surg. 2023 Mar 7;23(1):49. doi: 10.1186/s12893-023-01948-1, PMID 36882774.
18. Pennington M, Grieve R, Black N, Van Der Meulen JH. Cost effectiveness of five commonly used prosthesis brands for total knee replacement in the UK: a study using the NJR dataset. PLOS One. 2016;11(3):e0150074. doi: 10.1371/journal.pone.0150074, PMID 26943789.